Mastering Command and Control: The Brigade Commander's Environment In The Airland Battle

A Monograph
by
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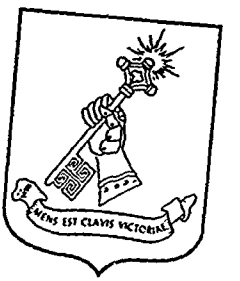
Military Intelligence



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ABSTRACT

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This monograph addresses the impact of the Army Tactical Command and Control System (ATCCS) at the brigade level of command. The study is significant due to the changing role of the brigade in Airland Battle doctrine and the impact of new command and control (C2) technology.

The study utilizes C2 evaluation criteria suggested in a RAND Corporation study, Understanding Commanders' Information Needs. The focus of the criteria is to evaluate whether or not C2 systems deliver available information to the commander in a timely and usable manner.

Historical analysis of the brigade level of command shows it has generally possessed adequate C2 capabilities in keeping with it's doctrinal role. An examination of current doctrinal literature identified flexibility and synchronization as two critical capabilities for Airland C2. A review of ATCCS indicates that synchronization functions tend to dominate system design. Furthermore, the brigade level C2 is now responsible for significant amounts of manually inputted data to support ATCCS sub-systems.

The monograph concludes that a lack of integration exists between ATCCS design, Airland Battle doctrine, and C2 support for the brigade level of command. The principal cause appears to be a lack of clear command and control doctrine which can be translated into system design requirements. Until this problem is solved, the U.S. Army will continue to be provided with equipment that provides increasingly large quantities of data, over faster acting, complex communications systems that do not necessarily improve the C2 capability of the supported commander.

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Part One: Introduction

> It takes a very brave commander to trust a computer program to decide what is, and is not, brought to his attention.1

On the contemporary battlefield the armored or mechanized (heavy) brigade commander has a particularly unique and demanding role to play in AirLand Battle (ALB) doctrine. The heavy brigade is the only tactical level headquarters with no organic combat units, possessing only its headquarters and headquarters company. All other units are attached as the needs of the mission dictate. The brigade's primary focus is to conduct close operations to defeat the enemy while protecting its combat support (CS), combat service support (CSS), and command and control (C2) facilities through effective rear operations.2

Until quite recently, the traditional C2 capability at brigade-level has been frozen in 1960's-era technology. With the advent of the Tactical Fire Direction Computer System (TACFIRE) in the late-1970's and the Tactical Army Combat Computer System (TACCS) in the 1980's, the fire support and logistics functions of the brigade became partially automated. A truly integrated brigade C2 system awaits the fielding of the Army Tactical Command and

Control System (ATCCS), which promises a significant qualitative improvement in the manuever commanders command and control options (see Appendix 1).

This study addresses the question of what impact does ATCCS have on a brigade commander's C2 environment? The introduction of new technology implies a change in both physical capabilities and procedural techniques. These changes alter what information a brigade commander can expect to have available. Also, he will have different options in controlling the battle. These changes will be addressed in the monograph.

This study synthesizes research from a variety of sources to accomplish several tasks. First, the doctrinal expectations of ALB C2 at brigade-level and the brigade commander's information requirements will be identified. Secondly, the command and control system in a current (1990) heavy brigade headquarters will be examined. The characteristics of the brigade C2 environment will be analyzed through a study of appropriate official documents such as field manuals and field circulars, combined with articles in professional journals. Next, ATCCS will be evaluated by examining each sub-system's ability to address the following criteria:

> (a) Is the information system organized to consolidate major functions and to shorten communications paths?

(b) Is there a single point in the information system which the commander and staff can refer to if they need basic situation information in a hurry?
(c) Is the information system capable of extension or contraction as needed by the commander?
(d) Is the information system tailorable to commander's information requirements?3

These criteria were suggested in a RAND Corporation study entitled, Understanding Commanders' Information Needs. The study's authors examined the interrelationship between commanders, C2 systems, and headquarters staffs during corps and division level command post and Battle Command Training Program exercises.

To summarize the study's findings, the authors found that the key to effective C2 systems was the ability to successfully fulfill the four criteria listed above. In the words of the authors,

> The problem is viewed as a function not so much of unavailable information as of getting the right information in the right form to the right place at the right time, to be used in the right way. Each of these elements --content, format, location, timing, and use -- is **necessary** (authors' emphasis) to good command and control.4

After examining ATCCS against the criteria, I will offer my conclusions and the implications for future C2 design.

For the purposes of this monograph two assumptions have been made. First, each ATCCS sub-system will be assumed to fully capable of performing to its design specifications. Second, personnel will be assumed to possess the required technical expertise to carry out their

assigned duties.

Although this study focuses on ATCCS, the underlying topic under examination is brigade-level command and control. Command and control is defined to mean the following:

> The exercise of command and control is the process through which the activities of military forces are directed, coordinated, and controlled to accomplish the mission. This process encompasses personnel, equipment, communications, facilities and procedures necessary to gather and analyze information, to plan for what is to be done and to supervise the execution of operations.5

From this doctrinal definition, the two principal qualities of C2 can be identified. First, there are the technical means which consists of communications systems such as radios and automated data processing equipment. Secondly, there are the organizational means which comprise the unit organization, assigned personnel, and standard operating procedures (SOPs). The words 'command and control' are used in concert because beyond the company-level you cannot have one without the other.6 At company-level and below, command is exercised directly by the commander on the object of command, the platoons. The company commander does this by directing the platoon leader with orders. This method changes at battalion-level and higher where a control organ in the form of a staff is introduced. A brigade commander uses the staff to perform functions necessary for him to command his battalions. The

object of his command is his subordinate battalion commanders.7

From an historical standpoint, the brigade commander as a distinct tactical leader dates back to the Napoleanic wars. His scope of command was limited due to the confined physical environment. A brigade frontage of 100 to 300 meters was typical. The brigade commander could see his entire area of responsibility, while under the direct supervision of his division commander.8 There was no need for C2 in the modern sense.

By World War I, the brigade commander's responsibilities increased in terms of both resources and space. For example, a typical American infantry brigade commander of 1918 had two infantry regiments for a total of six infantry battalions. Brigade frontages averaged 4 to 6 kilometers in width.9 Brigade commanders could generally see their entire area of operations and frequently led from the command posts near the front of their formations. However, the brigade commander was now physically removed from the division commander. The use of couriers and wire-connected field telephones and telegraphs were the principal means of communications between brigade, and division commanders.

During World War II and through the Korean War, the United States Army abandoned the brigade and developed regimental combat teams for infantry divisions and combat commands for armored divisions. Each regimental combat

team consisted of one infantry regiment with three infantry battalions, one 105mm artillery battalion, one engineer company, and other supporting elements.

Armored divisions were provided with three combat command (CC) headquarters, CCA, CCB, and CCR (Reserve). Each combat command was generally a variable combined arms package of tank, armored infantry, and self-propelled artillery battalions. Combat command frontages were situationally dependent, but five kilometers was a typical width in static situations.10

Tactical command and control had become more dispersed since World War I. The use of radios became widespread as brigades conducted wide ranging and semi-independent actions. Radio Teletype (RATT) and continuous wave (morse code) communications over high frequency transceivers dominated regimental and higher level communications. Frequently combat command and regimental commanders physically placed themselves in the area of their command's main effort, as they could not longer see their entire area of responsibility.11

By the late 1950's the regiment and combat command headquarters gave way to the heavy brigade structure of the 1960's which appeared under the Reorganization Objectives Army Division (ROAD)12 structure. Division '86 and Army of Excellence force structure developments have retained the brigade as a headquarters capable of accepting force

packages of two to five combat arms battalions.13 Contemporary doctrine does not specify frontages for any echelon of command. It has been the author's experience, during staff exercises at the Command and General Staff College, that a brigade can be assigned a sector of responsibility varying from 10 to 25 kilometers.

The evolution of the brigade level of command since the turn of the century shows several clear trends. Brigades have been generally downsized from a high of 12 battalions in World War I to as small as 2 battalions in a contemporary task organized brigade. Brigades have evolved from fixed organizations with organic subordinate combat units to headquarters capable of commanding a variety of tailored units. Finally, the brigade's area of responsibility grow from approximately 10,000 square meters to 600 square kilometers.

The net impact of these trends has created a command environment which has vastly expanded the physical scope of the brigade commander's tactical area of operations without a correspondingly more effective C2 means. Manual staff procedures still dominate. Transmission of information is largely verbal, with lengthy transmission times and numerous associated written records.

In concert with increased physical dimensions, is the expanding requirement for data from the divisional and higher levels. The officer population on division level

staffs has expanded 80 percent compared to its World War II counterpart. This enlarged officer population exists to gather, collate, analyze, and disseminate some 900 reports a day.14 Instead of a supply push from subordinate headquarters there is a demand pull of information from higher headquarters.

The net effect for the brigade commander is that he has to deal with a fluid task organization, satisfy data demands by an enlarged division-level staff whose purpose is information gathering and monitoring, and use C2 means that are time and manpower intensive. Furthermore, his highly mobile units are scattered over increasingly large areas of operation. This is the environment that ATCCS is seeking to address.

Part Two: Current Brigade Command & Control Doctrine

> The commander who is kept up-to-date on the battlefield situation without being overloaded is in the best position to make sound decisions. The staff which shares information has the broad base of knowledge needed to develop integrated and sensible plans.15

This section will examine current U.S. Army C2 doctrine and will attempt to specify its application at the brigade level of operations. This is a difficult task as the U.S. Army does not have a doctrinal manual on brigade command and control or C2 in general. Therefore, I will first examine the doctrinal literature that deals with the monograph topic. Then I will summarize and synthesize a brigade C2 doctrine.

Brigade-level command and control doctrine is distributed in the following six field manuals:

General doctrinal field manuals:
- FM 100-5, Operations
- FM 101-5, Staff Organization and Operations

Unit operations field manuals:
- FM 71-3, Armored and Mechanized Infantry Brigade
- FM 71-100, Division Operations

Communications field manuals:
- FM 24-1 Combat Communications
- FM 11-50, Combat Communications within the Division (Heavy and Light)

The first two field manuals set the general command

and control conditions. The brigade and divisional level field manuals essentially echo the themes of the first two manuals. Therefore it is logical to examine the first four field manuals as one group and then examine the communications field manuals as a separate group.

Beginning with the first manual, FM 100-5, ALB Doctrine requires a C2 system capable of two principal characteristics:

- Facilitates freedom to operate [mobility and range].
- Delegation of authority and leadership from any critical point on the battlefield [flexibility].16

These characteristics fit the ALB vision of high tempo, far-ranging, and dispersed operations. Under these conditions, the tactical commander must be able to reposition himself anywhere on the battlefield, yet retain the capability to maintain command and control. The ability to delegate, recognizes that multiple critical situations can occur requiring the commander to delegate authority or be overwhelmed by events. This viewpoint is derived from the historical trends similar to those examined earlier in this study.

The importance C2 plays in current doctrine is also highlighted in the four ALB tenets discussed in FM 100-5.

> Initiative: In the chaos of battle, it is essential to decentralize decision authority to lowest practical level because overcentralization slows action and leads to inertia.
>
> Agility: . . .leaders must continuously 'read the battlefield', decide quickly, and act without hesitation.

> **Depth:** Commanders must see beyond the requirements of the moment, actively seek information on the area and the enemy in depth, and employ every asset available to extend their operations in time and space.
>
> **Synchronization:** In the chaos of battle, when communications fail and face-to-face coordination is impossible, such implicit coordination [commander's intent] may make the difference between victory and defeat.17

The discussion of the tenets furthers paints the picture of the future ALB battlefield. The "chaos" of battle will be a normal condition. Command and control systems will fail or be subjected to interference. Commanders will only be able to see fragments of the battlefield. Active efforts will have to be made to establish a true image of what is occurring on the battlefield. Uncertainty will prevail. Command and control will be able to provide answers to only part of the information puzzle.

The ALB tenets contain a number of seemingly contradictory statements. The desire for the commander to maintain control is evident in the discussions of agility, depth, and synchronization. However, the discussion of initiative clearly indicates a need to decentralize to achieve speed of action. Also, the field manual recognizes the friction of battle will frequently interrupt a commander's control means.

In determining a doctrinal primacy between centralization or decentralization, FM 100-5 sends mixed

signals. As mentioned earlier, the ALB tenets suggest a priority to centralization as a means for the most efficient concentration of combat power. However, later in the same chapter the manual emphasizes,

> The ultimate measure of command and control effectiveness is whether the force functions more effectively and more quickly than the enemy.18

The impression is that the doctrinal writers recognize that there are tradeoffs and that both the brigade commander and his C2 structure must be flexible enough to adjust to the situation.

Regardless of the external C2 situation the, the brigade commander and staff will be performing certain internal procedural tasks as part of the C2 process. As specified in FM 101-5, Staff Organization and Operations these are:

1. Assignment of mission from the division commander.
2. Acquisition and processing of the information on the situation. This is a joint function of both commander and staff, as the level of command increases, it becomes more of a staff function vice commander function due to the complexities and volume of information.
3. Commander's planning guidance.
4. Staff estimates.
5. Commander's estimate.
6. Preparation of plans (orders).
7. Issuance of orders.
8. Finally, the commander and staff supervise the readiness of the troops for combat and their actions in carrying out the mission.19

The key to success in this process is maintaining sufficient information to quickly arrive at a decision. A resident data base is established by the brigade

commander's requests for information. These information needs are translated into either threat-related or friendly-related requirements. Threat oriented requirements are called:

> Priority Intelligence Requirements (PIR) -- Those intelligence requirements for which a commander has an anticipated and stated priority in his task of planning and decision making.
>
> Information Requirements (IR) -- Those items of information regarding the enemy and his environment which need to be collected and processed in order to meet the intelligence requirements of a commander.20

Friendly force information requirements are:

> Commander's Critical Information Requirements (CCIR)- Critical, time sensitive items of information jointly determined by the commander and staff for each of the Battlefield Operating Systems, and these CCIR then guide subsequent information collection efforts. CCIR are dynamic, constantly changing as the situation changes, and are dependent upon the personality and decision making of the commander.21

Currently, there are no doctrinal friendly critical information requirements. This void has been addressed in several studies. In his MMAS thesis entitled, Battle Staff Operations: Synchronization of Planning at Battalion and Brigade level, MAJ William F. Crain summarized four major studies and suggested the following brigade commander's critical information requirements (CCIR) ranked in order of importance. From this set of CCIR, Crain refined a list of minimum essential information (MEI). Recognizing that the decision making process is time constrained, MEI indentify those items which permit the commander to arrive at a decision in the shortest possible time.

MINIMUM ESSENTIAL INFORMATION22

INFORMATION ITEM RESPONSIBILITY	STAFF
Assets Available	S4
Command Mission	S3
Subunit Missions	S3
Task Organization	S3
Adj Unit Situation	S3
Enemy Activity	S2
Cdr's Intent	Cdr
CSR	S4
Area of Operations	S3
Terrain & Weather	S2
Priority Eng Spt	S3
Priority Fire Spt	S3
CONOPS	XO
Move Instructions	S4
Time Available	XO

In the brigade environment, the staff provides and monitors the aforementioned items of information or MEI (derived from CCIR, PIR) as dictated by the commander. This is part of the control function in C2. Success or failure of the brigade C2 system depends upon its ability to fulfill the MEI requirements.

In examining the doctrinal military decision making process it appears that emphasis is on efficiency and precision, rather than speed and agility. The steps involving the staff estimate process and then comparing it with the commander's estimate are time consuming and seem more concerned with achieving group consensus than swifty choosing an effective course of action. If the MEI are effectively being answered, the commander's information needs should be readily fulfilled.

It is beyond the scope of this monograph to fully examine the implications of the U.S. Army's military decision making process. However, the organizational process is part of C2 and cannot be totally ignored.

Summarizing the salient points of the first four field manuals does assist in identifying the apparent focus of doctrine on brigade command and control. The ability to centralize C2 to mass combat power is emphasized in FM 100-5. Also, flexibility to decentralize is a desired characteristic for speed of operations and to work through the friction of battle. The military decision making process in FM 101-5, correctly emphasizes the need for key items of information. But the doctrinal decision making process is lengthy and does not specifically address critical information requirements concerning friendly forces.

Significantly, FM 101-5, Staff Organization and Operations, is currently under revision. The coordinating draft, dated March 1990, is retitled Command and Control for Commanders and Staff. It represents a major shift in emphasis from the May 1984 document as evidenced by comparing the purposes of the two manuals as stated in their prefaces:

> FM 101-5, May 1984 This manual prescribes basic doctrine for staff organization and operations. It is intended for use by staff officers in carrying out their duties and responsibilities as they assist the commander in accomplishing the mission.23

FM 101-5, (Coordinating Draft) Mar 1990 This field manual is the Army's capstone command and control (C2) publication for Airland Battle [sic]. It describes the roles, relationships, organization and responsibilities of the commander and staff.24

Shifting now to a more technical discussion of C2, the communications field manuals, FM 24-1 and FM 11-50, emphasize technological capabilities. These two documents identify key AirLand Battle doctrine characteristics which make new demands on communications systems technology:

* Area based structure.
* Common user systems.
* User responsibilities for installation and operation.
* Increased redundancy and mobility.
* Use of signal nodes and relocation for survivability.25

These characteristics have been driven by the previously discussed trend toward highly mobile, continuous, and non-linear operations. Area based structure has been driven by the requirement to support concurrent deep, close, and rear operations over a large geographic area. Common user systems are designed to ease communications integration and training. Increased user responsibility for maintenance and installation of communications equipments recognizes the inability of the signal community to be everywhere on the battlefield. Finally, increased threat capabilities to disrupt or destroy semi-fixed, dedicated communications systems have accelerated the employment of more survivable C2 means

through redundancy and mobility.

To meet these challenges the U.S. Army signal community has turned to the communications-electronics industry for solutions. To meet the area based requirement systems such as satellite-relayed communications (SATCOM) and mobile cellular telephone and data transmission systems have been introduced. The former system provides global range, secure communications limited only by the number of channels available in the relay satellite.20 The latter provides the military with mobile, digitized data capability far in excess of that provided by older multichannel equipment.

The communications manuals do not enter into the debate between centralized and decentralized C2. The preference appears to be to provide the brigade commander with the best available communications hardware and let someone else sort out the command and control techniques to be used.

From current doctrine the ALB C2 points can be summarized as follows:

> Centralized information management.
> Decentralized decision authority.
> Abundant communications capability.
> Quickly read the battlefield, decide and act.
> Actively seek information and employ all assets.
> When communications fail, understanding of the commander's intent and subordinate initiative is key.

Doctrine has painted the picture of a fluid, chaotic, and destructive battlefield. The traditional means of

dealing with distributed mobile operations is, in the words of Martin Van Creveld, "to decentralize the chain-of-command and rely on intelligent initiative at every rank, beginning with the lowest, in order to seize every fleeting opportunity and exploit it to the hilt."27 In these circumstances we could expect to see C2 systems that are the minimum necessary to conduct operations.

U.S. Army doctrine is vague on this issue of minimal communications consistent with speed of operations. Once again the basic competition between centralized control to achieve maximum combat power versus decentralized control to emphasize agility lies at the center of the issue.

In the absence of a clear priority, the communications doctrine attempts to be all things to everyone. The intent of the signal community is provide the technical C2 capability for both centralized and decentralized operations. The are two dangers with this approach. The first is the assumption that there will always be sufficient fiscal resources to provide both centralized and decentralized C2 capability. The second is that when centralized control is availability, the tendency is to use it. It is my experience, that abundant, non-interrupted C2 leads to an emphasis on elaborate, detailed, and time synchronized tactics. Tempo of operations becomes secondary to the maximization of combat power.

The brigade level is the crossroads for tactical

command and control. The span of control exceeds the ability of one commander to monitor all the acitivities. The availability and capability of brigade C2 will determine whether centralized or decentralized control techniques will be used. This study will now examine the Army Tactical Command and Control Systems to see what command technique technology will support.

Part Three: Brigade Command and Control

> At the moment of battle, information about the strength of the enemy is usually uncertain, and the estimate of one's own is usually unrealistic.28

The pre-ATCCS brigade-level C2 system is highly structured and has limited access to the various organic tactical communications media. Brigade commanders use the tactical command post (CP) to position themselves in the area of main effort and rely primarily on voice communications system to tie them in to the wider brigade battle. The brigade main CP or tactical operations center (TOC) provides the supervision of the entire brigade area of operations and ties into division headquarters. The principal means of mobile C2 has been through use of single channel combat net radio, usually of the VRC-12 series of equipment which provides voice only communications. The use of data base management systems and networked C2 systems is limited to the fire support and combat service support areas. Wire, messenger, and RATT are still available, but are generally used as back-ups to the radio systems.29

The future fielding of Army Tactical Command and

Control System (ATCCS) at brigade level will introduce integrated battlefield automated systems with common hardware and software. This system consists of the five sub-systems, Manuever Control System (MCS), Advanced Field Artillery Tactical Data System (AFATDS), All Source Analysis System (ASAS), Forward Area Air Defense Command, Control and Intelligence System (FAAD C2I), and Combat Service Support Control System (CSSCS) (see Appendix 1). The five systems will be laterally integrated by three communications systems, Single Channel Ground Airborne Radio System (SINCGARS), Mobile Subscriber Equipment (MSE), and Army Data Distribution System (ADDS).30 For purposes of analysis, each pre-ATCCS C2 systems will be compared and contrasted with its ATCCS equivalent in the following functional areas: manuever, fire support, intelligence/ electronic warfare, air defense, and combat service support. By this comparison and contrasting process, significant changes in C2 capability can be identified and evaluated against the designated criteria.

Manuever.

For manuever C2, the pre-ATCCS brigade commander has the traditional means of radio, multichannel, and radio telegraphy (RATT). The primary means of high capacity voice and data communications for battalion and higher headquarters is multichannel or trunk communications. Multichannel equipment is capable of digital data

transmission, which permits on-line encryption and high transmission capacity. However, multichannel suffers from being a non-mobile fixed site system, requiring lengthy set-up and tear-down. For written traffic the teletypwriter provides a rapid method of transmitting messages over wire or multichannel circuits or by radio.31

Other traditional means are still available such as courier, wire, and personal visits by the commander. Courier message traffic is still routinely conducted on a scheduled basis. This method suffers from a lack of speed in delivery and direct sender-to-receiver transmission. Wire is confined to physically limited areas such as main command posts or support areas. Lack of mobility and extended installation time, limit the effectiveness of wire in mobile tactical operations.

Personal visits by the brigade commander are a traditional and still important C2 technique. Air transportation has greatly increased the range of the commander. The use of the helicopter to rapidly move about the battlefield became prevalent during the Vietnam War. While the helicopter provides rapid and convenient transportation, in mid-intensity conflicts, its use will be limited by enemy activity and weather.

For maneuver control under ATCCS, MCS serves the brigade commander by providing automated assistance in the coordination of plans, dissemination of orders and

guidance, and the monitoring and supervision of operations. The MCS is a data-base manager, word-processor, graphics generator, and communications device. This system is a significant advance in C2 capability providing highly integrated and automatically networked terminals from corps down to brigade level.32

Manuever Control System is fully compatible with all current communications devices and will utilize MSE, wire, or VRC-12/SINCGARs systems. The system comes with three nodes or operator consoles, Tactical Computer Terminal (TCT), Tactical Computer Processor (TCP), and Analyst Console (AC). Each brigade will have two TCTs, two TCPs and five ACs (see Appendix 2). The principal difference between the three nodes is that the TCP and TCT can communicate with MCS consoles at other headquarters over MSE and SINCGARS. The Analyst Console can only transmit and receive data when connected by a local area net (LAN) with a TCP/TCT node which have communications ability. Furthermore, the TCP and AC can only operate when stationary. However, the AC does permit remote station processing and expands the work stations in a brigade TOC. Only the two TCTs are vehicular mounted and usable in a mobile mode.33

At brigade level the most important effect of MCS is the increased capability and demand it places on data processing. Once the data is manually inmputted into MCS,

it is easily manipulated and communicated. However, the brigade is responsible for entering the data for all subordinate battalions and separate companies.

Fire Support.

The Tactical Fire Direction Computer System (TACFIRE) and Light TACFIRE (LTACFIRE) are the current computerized field artillery automated fire control systems. Developed in the late-1960's to early 1970's, these systems suffer from excessive size, weight, and inflexibility in use. TACFIRE only addresses ten of the twenty-seven recognized fire support functions and cannot handle naval gunfire or close air support assets. The systems also are limited to processing only 60 fire missions per hour.34

In order to expand these limitations, the Advanced Field Artillery Tactical Data System (AFATDS) intends to provide fully automated support features. Support for planning, coordination and control of all fire support assets in the execution of close support counterfire, interdiction, suppression of enemy air defense and deep operations will be provided. AFATDS will allow the processing of 720 fire missions per hour.35

The system will be equipped to receive target location data from non-traditional sources by data link transmission. Both Army and Air Force airborne platforms will be able to pass target data directly into the AFATDS system. In addition, AFATDS can coordinate the use of

counterbattery radars and intelligence collection systems, such as Guardrail, into a "quick fire" channel. This will provide a near instantaneous engagement of identified targets.36 For the supported manuever brigade, AFATDS promises not only a higher capacity for fire missions, but also allow the brigade FSO to assume the fire planning and execution capability of the direct support field artillery battalion.

Intelligence/Electronic Warfare.

Current brigade IEW support is an entirely manual operation. The brigade is the entry level for all intelligence data gathered by brigade and subordinate units. Transmission of intelligence data and tasking requirements is normally over combat net radio, multichannel, or RATT. The system is manpower and time intensive. As a short term solution, MCS does provide an analyst terminal to the brigade S2 section.

The ATCCS intelligence related system, the All Source Analysis System (ASAS), will be used to fuse and correlate tactical and strategic intelligence reports for the use of the tactical commander (see Appendix 3). ASAS has artificial intelligence software to assist in processing and analyzing intelligence data. A problem has been created due to the data link into real-time intelligence collection systems handling special compartmented information (SCI). Consequently, ASAS is currently limited

to use in SCI cleared facilities at division level and higher. Brigade access to ASAS information will be through normal G2/S2 channels.37

Air Defense.

Current tactical air defense C2 is a non-automated system using HF voice radios to provide a division wide air warning network. There are currently air defense radars in several divisional air defense artillery (ADA) battalions. These radars are in the process of being phased out of service with no near term replacement. Consequently, radar early warning will require a corps level HAWK unit to provide this capability to the division ADA battalion. Otherwise the division and brigade have only a visual acquisition capability.

The Forward Area Air Defense (FAAD) C2I system, is intended to provide the brigade commander access to an integrated air defense network capable of rapid detection, identification, engagement, and destruction of enemy air threats.38 The FAAD C2I system will operate with a network of ground based and aerial radar systems designed to detect and track air platforms (see Appendix 4). The system is structured to provide timely alerting of supported combat manuever units of enemy air threats. The actual interface of FAAD C2I with a brigade's C2 system is still under development. However, a brigade TOC can at least expect an ADA LNO element with a data linked terminal which will

provide continuous reporting of ADA unit/weapons platform locations and both friendly and enemy air activity.

Combat Service Support.

Current brigade-level CSS functions are partially automated with the Unit Level Computer (ULC) system and the tactical Army combat service support computer system (TACCS). Both systems are currently fielded at brigade and battalion level.

The ULC is the basic system for battalion level CSS. It is a commercially purchased lap-top portable computer designed to reduce manual logistics documentation. Current ULC software performs prescribed load list, supply, and medical computations. This system is not designed to net with other CSS automation systems. Actual physical transference of data in either disk or paper form is required.39

At brigade S1/S4 and higher echelons, TACCS is the current automated data processing system. Weighing in at 429 lbs., TACCS is considerably larger than ULC. The computer manages property book, retail supply, ammunition, maintenance, standard installation/division personnel system (SIDPERS), and calibration management functions. A stand alone system like ULC, TACCS requires the manual transference of data between brigade and other levels of command.40

Once the networking problems have been solved, the

Combat Service Support Control System (CSSCS) will provide automated support for planning, coordinating and controlling CSS assets under the ATCCS concept. Currently in development, CSSCS is not scheduled to be fielded for initial operational capability tests until the third quarter of FY 1993.41

These five major sub-systems of ATCCS provide significant improvements in the capabilities and capacity of brigade C2 systems. Linking the systems with the new communications means is intended to provide previously unavailable systems interoperability. Utilizing common hardward and software features, the three communication systems will link the ATCCS sub-systems and create a synergistic effect in data management. Transference between systems will avoid the tradional stove pipe flow of information.

The three communications systems are currently in varying stages of development. Mobile Subscriber Equipment is now being fielded as a replacement for multichannel systems. Single Channel Ground and Airborne Radio System is being fielded to replace the AN/VRC-12, AN/PRC-77 and AN/ARC-54/131 family of radios. More than 15,000 sets are in U.S. Army units in South Korea and Southern Command.42 Providing data transferral and unit location reporting capability is the Army Data Distribution System (ADDS), which consists of two sub-systems. The Enhanced Position

Location Reporting System (EPLRS) is nearing final development and is expected to be fielded soon. Joint Tactical Information Distribution System (JTIDS) is the other half of ADDS. When fielded, JTIDS will allow the transfer of data between the five control systems of ATCCS.43

Mobile Subscriber Equipment (MSE).

MSE provides the brigade C2 system with a cellular telephone capability. The user components consist of two telephones, one non-secure, the other secure and both capable of transmitting facsimile and data information. Attachable to either telephone is a lightweight facsimile device, which can transmit or receive documents such as overlays, maps, and messages. The transceiver device is called a Mobile Subscriber Radio Telephone Terminal (MSRT). The radio has a full duplex capability and a planning range of 15 kilometers.44

Each individual mobile and static subscriber has an unique telephone number. Using the MSE system, each user can call throughout the MSE network, an entire corps for example. The limiting factors are the range from the subscriber to a node which allows access to the system. Also, the MSE nodes can be remoted up to 8 kilometers from the transmitters, improving static site survivability.45

Single Channel Ground & Airborne Radio System.

The Single Channel Ground & Airborne Radio System

is a frequency hopping FM radio system designed for use on combat net radio systems. It offers increased resistance to jamming and interference, increased reliability and over double the usable channels, 2,340 versus 920. Depending on the variant, man-portable or vehicular mounted, it has a range of 8 to 35 kilometers. SINCGARS is compatible with the KY-57 Vinson series of COMSEC equipment. Later versions of SINCGARS will have built-in COMSEC capability. In most other respects, the SINCGARS radios operate in the same manner as the radios it supplants.46

Army Data Distribution System.

This system consists of two sub-components. The first, Enhanced Position Location Reporting System, provides real time positioning data on all units equipped with an EPLRS radio set. The set is connected into a net control station which will serve a brigade sized area of operations. Unlike other electronic locating systems, EPLRS is not dependent on a satellite link for positioning data. Due to the characteristics of the system, location data is determined by automatic electronic triangulation. The system is sufficiently accurate to generate on demand an eight digit grid location with +/- 15-meter error for any user netted on the system. The locating system is currently configured to automatically report positions for dismounted troops ever 32 seconds, vehicles every 16 seconds, rotary wing aircraft every 8 seconds, and fixed

wing aircraft every 4 seconds.47

ADDS also contains a joint tactical information distribution system (JTIDS) access capability. JTIDS is a secure, data UHF burst communications system which will serve as the electronic interface to the five systems of ATCCS. Designed to initially provide the data network capability for FAAD C2I airspace management, JTIDS also provides the brigade with secure text message transmission capability. The package of EPLR/JTIDS is currently being field tested.48

The net effect of ATCCS at brigade level is one of qualitative improvement in the area of data integration, management, and transmission. The hardware improvements are in systems reliability, longer range, and speed of processing.

Going back to the discussion earlier in this section, the preferred method of tactical command remains physical presence. Oral communications is the next effective means of command. The least effective means is the use of textual data. However, it is in the area of data capability that ATCCS has focused. The implications of this area of concentration on brigade command and control will now be looked at.

Part Four: Analysis

> War being by nature confused and the process of command complex, it is virtually certain that some breaks and errors will occur, a fact that a wise commander will take into account and provide for.49

At the beginning of this study, we saw how the brigade area of operations was ever increasing while the C2 means for collection, processing, analysis, and transmission remained predominately non-automated. We then saw that doctrine placed dual requirements for C2 flexibility and synchronization. Furthermore, doctrine recognized that the environment of the AirLand battlefield would create numerous opportunities for uncertainty. After examining the features of ATCCS, we saw that design features addressed flexibility and survivability issues raised by ALB doctrine. But we also discovered that ATCCS makes demands at the brigade level.

In analyzing the impact of ATCCS at brigade level, the criteria will be applied to show the effectiveness of ATCCS in the brigade environment. The chosen criteria addresses the ability of a C2 system to group information by task, find needed information at one point, search for additional details when required, and be tailored to meet the supported commander's information needs.50 In order

to accomplish any mission, many bits of specialized information must be assembled and laterally moved about the staff. Enemy situation, friendly logistics status, location of units are examples of information that are shared among the staff sections for mission planning and monitoring. The tactical operations center provides the centralized repository for information. When the readily available data is inadequate for the information requirement, the system should be able to extend itself to locate the answer to the query. Finally, the C2 system should be tailorable to the supported commander's MEI. If the commander has to accept the information provided without being able to establish the priorities, he risks not getting what he needs.

Each sub-system of ATCCS generally achieves the desired consolidation of functions within traditional staff areas of responsibility. Lateral interface between the brigade staff elements is best served by MCS. The availability of nine MCS, local area netted, consoles provides the consolidated database. The MCS consoles link S2, S3, engineers, chemical, and signal staff elements. Fire control, air defense, and CSS will remain more autonomous functions. How the data interface will work through ADDS remains to be developed and proven in field use. Until ADDS is in operation, lateral interface will still be conducted by manual staff coordination.

The greatest consolidation failing in current ATCCS design is in the intelligence/electronic warfare system. The flow of intelligence information from echelons above brigade downward will still suffer traditional time lags. The information flow 'choke point' is likely to occur at the division G2 all source analysis section. This section will have to manually sanitize and transfer intelligence data from ASAS to MCS for use at brigade. The intelligence function under ASAS remains an echelon away from brigade for the forseeable future.51

The next aspect of analysis, single point access to available system information, is adequate, given the aforementioned failing with ASAS. At the brigade TOC, each ATCCS system, except ASAS and CSCSS, will have an access console or operator terminal. The brigade will have organic MCS equipment. Two systems, AFATDS, and FAAD C2I will be provided by the attached unit responsible for that function. The remaining system, CSCSS, will reside at the forward support battalion in the brigade trains area.52

The brigade tactical CP will be less endowed with ATCCS access. As currently configured, only MCS and AFATDS consoles will be routinely available in sufficient numbers to provide the tactical CP with equipment. However, this may not prove to be a shortcoming. The two available systems will provide the same data as was normally available in the pre-ATCCS tactical CP.53

System flexibility, the ability to address unanticipated information requirements and answer them quickly, is dependent on each ATCCS sub-systems data-base design. For example, MCS uses formatted data log forms for friendly and enemy unit status reports. If the specific inquiry goes beyond the resident information, a query will be needed to address the question. On the other hand, EPLRS provides constant real-time updating of unit positional data. Any inquiry automatically generates a verification of a current EPLRS user location.[54]

Taking ATCCS as a whole, all the sub-systems use formatted data entry. Within each functional area, there is the capability to query the system for additional information. Answering the questions will have to be handled manually for information not in the resident data bases. So ATCCS is flexible as defined by the criteria. However, the more data that is requested that is not in the data base, the more manual the process becomes.[55]

The final criteria to be considered is the brigade commander's ability to tailor ATCCS to meet his information needs. Basically, the brigade commander will be unable to tailor any ATCCS sub-system to his specific information needs. Parameters for information reporting in ATCCS will either be top-down driven, as in MCS,[56] or determined within the functional area, such as AFATDS and FAAD C2I. The brigade commander's C2 tailoring options are limited to

standard operating procedures (SOPs), location of available C2 systems, and his personal command style. Through the judicious use of SOPs, the commander can influence the speed with which his PIR and CCIR are answered. He can likewise dictate the division of responsibilities of the tactical command post, tactical operations center, and rear command post to minimize duplication of effort and reduce decision making time. Lastly, the physical location of the commander will determine the focus of the brigade C2 effort.

From the criteria analysis, the advantages and disadvantages of ATCCS at brigade level become more apparent. Taken as a whole, ATCCS does not appear to be designed to facilitate command and control functions at the brigade level. The impact on the C2 environment at brigade level may be exactly the opposite. The principal drawback to brigade level ATCCS is the laborious process of data entry. The brigade headquarters will have to dedicate personnel to perform this function. I can attest from personnel experience that a brigade staff is austerely manned in the current MTOEs. The requirements to feed the data for the resident ATCCS systems carries the potential for creating increased information demands on the brigade headquarters without an equivalent payoff in improved brigade C2 capabilities.

Within ATCCS, the lack of direct ASAS access is a

notable drawback. The ability to access information from echelons above brigade is limited to the formatted intelligence sub-routine in MCS. This potential intelligence "choke-point" does not favor the brigade's ability to see deep into the enemy's first tactical echelon, let alone any follow-on echelon.

Several additional key points are evident. Due to the capabilities of MCS, data management and transferral capabilities now exist where they had not before. In manuever functions, MCS will have the greatest impact on echelons above the brigade level. Due to a lack of MCS terminals at manuever battalion level, the usefulness of the system will be restricted for the brigade commander. The brigade TOC becomes the focal point for manually entering all the data required by the MCS system. Therefore, the information for the brigade commander will still be manually gathered and processed for his use.

Once AFATDS is introduced, the brigade commander should reap the benefits of a much more flexible and powerful fire support capability. With the brigade FSO gaining the ability to do the actual fire planning computations within the brigade CP, significant decrease in response time and increase in planning precision will be realized. This is a qualitative improvement in synchronizing the fire support aspects of brigade level operations.

In the area of intelligence support, the lack of a truly dedicated intelligence collection and analysis system at brigade level will continue under ASAS. Until concerns about handling sensitive compartmented information in a tactical C2 system are resolved, it is unlikely that ASAS will be available below division level. This leaves the brigade S2 with MCS as his principal data processing tool. Unfortunately, the previously mentioned drawback of brigade being the data entry level for MCS will also plague intelligence support. This area does not show signs of near term improvement for the brigade commander and staff.57

Air defense issues under ATCCS are a mixture of good news and bad news. The good news is that EPLRS and JTIDS are largely through the development phase and are being field tested. The ability to have near continuous updates on unit locations and to burst transmit text messages and data are significant qualitative information improvements for the brigade commander. The bad news is that the remainder of the FAAD C2I system must still undergo significant research and development hurdles. The biggest potential problem is fielding a ground based radar system capable of the demanding task of tracking large numbers of fixed wing and rotary wing aircraft under heavy electronic countermeasures conditions and ground clutter. The defense electronics industry is only marginally confident of

fielding a system capable of meeting the FAAD C2I requirements by the late-1990's.58

The existence of TACCS and ULC has done much to automate the bulk of CSS activities. Due to success of TACCS and ULC, there appears to be less pressure to quickly field the CSSCS portion of ATCCS. In the combat service support area, as currently conceptualized, the CSSCS terminal will reside with the brigade forward support battalion in the brigade support area. Colocation of the brigade S1/S4 will facilitate access to the data residing within the CSSCS system. However, the data entry level will be the brigade. This creates a third demand for entering data in conjunction with MCS data for manuever control and intelligence requirements.59

From studying ATCCS, it is clear a revolution in data management has occurred at echelons above brigade. So long as subordinate headquarters feed accurate and timely data into MCS, division and corps headquarters will thrive on the available information.

The brigade commander will eventually reap a few benefits from ATCCS. In air defense, fire support, and combat service support, the promise of enhanced C2 capability carries no support penalty from the brigade. These three areas provide internal data support and maintenance and do not burden the brigade with these requirements. This is in keeping with the attached

relationship of their associated units, ADA platoons, FSO, and forward support battalion respectively. The Mobile Subscriber Equipment's advanced communications capabilities are a true improvement over its predecessor. Also, EPLRS promises accuracy and timeliness on unit locations, addressing a major battlefield uncertainty.

The great irony is that the two key pillars of ATCCS, manuever control and intelligence/electronic warfare, indicate the least payoff for investment from the brigade commander's viewpoint. In these two areas of command and control, the brigade level C2 environment will remain largely unchanged. The price will be paid at the brigade TOC, where the staff incurs another significant task, manually inputting the data for the automated systems.

Part Five: Conclusions and Implications

> The place of all commanders of armour up to the divisional commander is on the battlefield, and within this wherever they have the best view of the terrain and good communication with the hard core of tanks. I was always located where I could see and hear what was going on 'in front', that is, near the enemy, and around myself-namely at the focal point. Nothing and nobody can replace a personal impression.60

In his book, The Future of Land Warfare, Chris Bellamy notes that military organizations have two fundamental choices to make regarding information. The first option is to increase the capacity of C2 systems to collect, handle, and process ever increasing amounts of information in an attempt to reduce or eliminate uncertainty. The alternative is to accept uncertainty as a norm and train to function without perfect information.61

With the ATCCS concept the U.S. Army has opted for Bellamy's first option. While there is little doubt that the systems exained in this study will provide the information they were designed for, it remains to be seen if this data will be of help to the commander.

Part of the problem rests with the competing demands of ALB doctrine, flexibility of command and synchronization of combat power. Both are highly desirable, but have

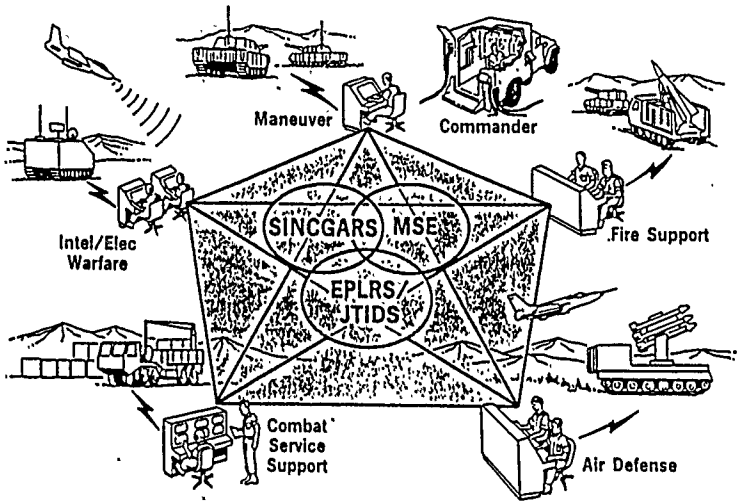
competing interests. Flexibility of command places the emphasis on professional competence, decentralized control, a common understanding of mission priorities, and speed of operations. Synchronization emphasizes centralized planning, time phased execution, and conformity of operations. These two concepts suggest they require fundamentally different C2 capabilities.

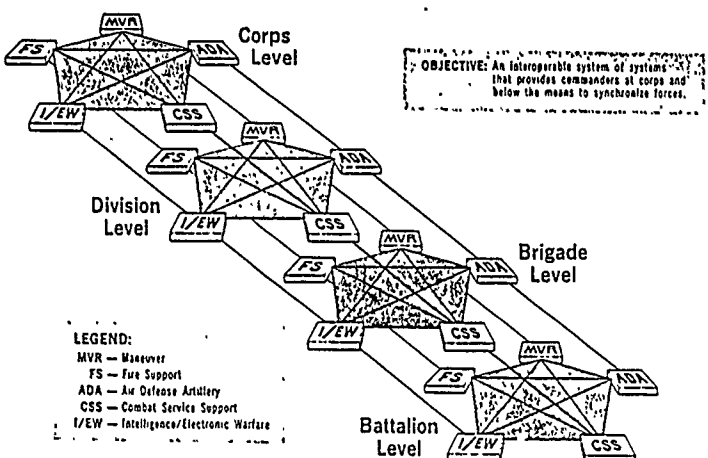
The other part of the problem rests with an institutional preference for quantifiable data over subjective effectiveness. In command and control it is easy to say that a given system can transmit 1200 bytes per second and that this is an improvement over 300 bytes per second. But it is hard to prove that having more bytes is necessarily an improvement in the quality of information. Every aspect of ATCCS provides more data than what was previously available. But is more data better command and control?

Until the U.S. Army establishes a C2 doctrine, the brigade level commander will arguably get the worst end of the results of the C2 revolution. The current C2 trend strongly favors synchronization. Under ATCCS, this tasks the brigade to feed the lion's share of the data into the MCS data bank. This is time consuming, diverts personnel away from other tasks and ultimately slows the pace of operations.

The implications for future C2 systems are obvious.

Although technology promises the key to eliminating uncertainty and the U.S. Army chases this ideal, we must beware of the drawbacks associated with achieving this capability. There is no free lunch. In this case, flexibility is compromised to achieve greater synchronization. As an institution, the U.S. Army appears both unwilling and unable to come to grips with defining and accepting the normal degree of uncertainty and friction that has existed in battle throughout recorded history. If the Army chooses to continue along the technology path, it must concentrate on providing the C2 support to the most important level, the units fighting the battle. The focus of the C2 revolution must be re-oriented to the brigade, battalion, and company level, from the bottom - up. In the end, if combat units are not successful in the tactical engagements, it makes little difference how much data is available to the higher level commanders.

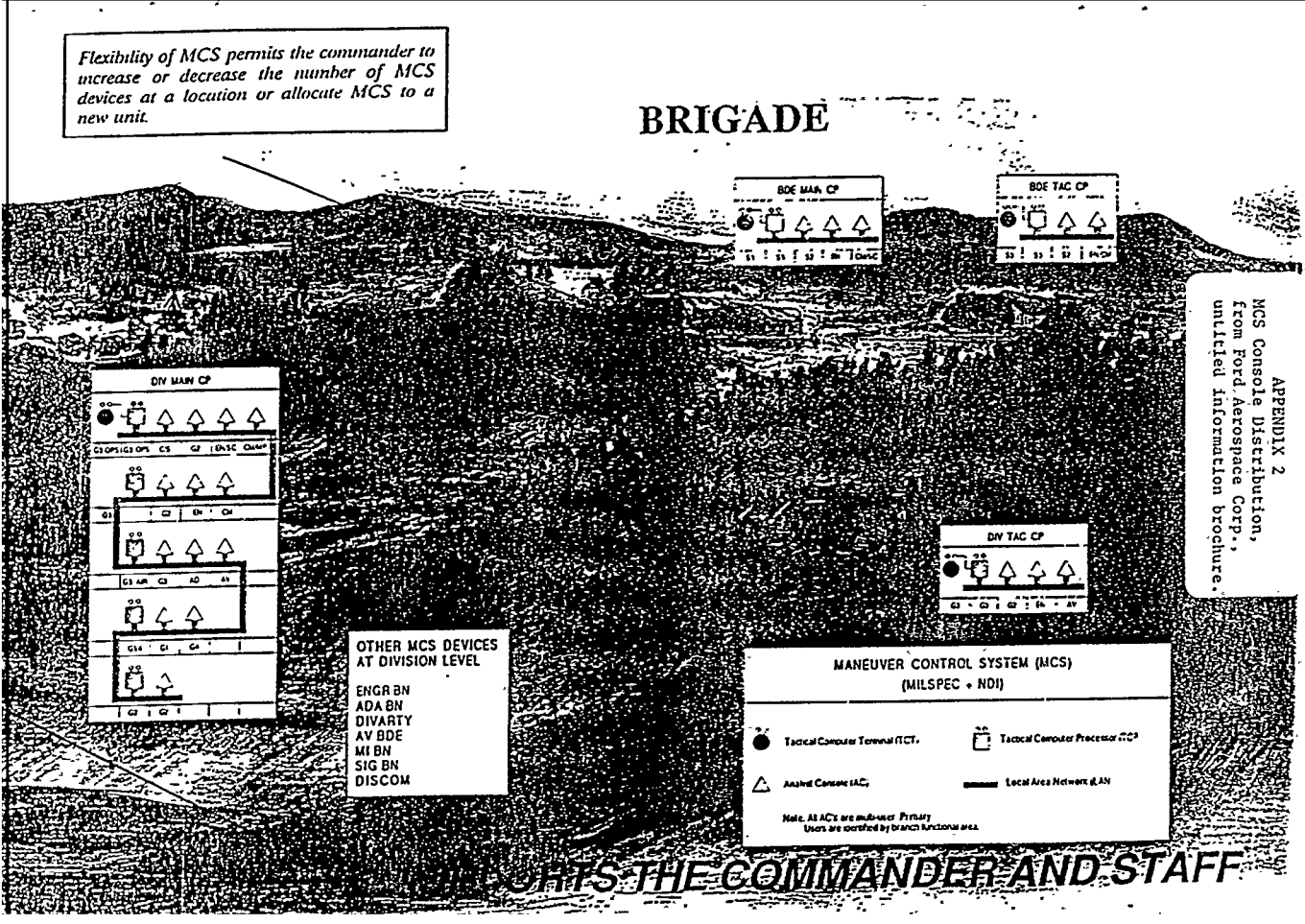




APPENDIX 1
Army Tactical Command and Control System, Military Review (Jun 90) pp. 37-38.

Flexibility of MCS permits the commander to increase or decrease the number of MCS devices at a location or allocate MCS to a new unit.

BRIGADE

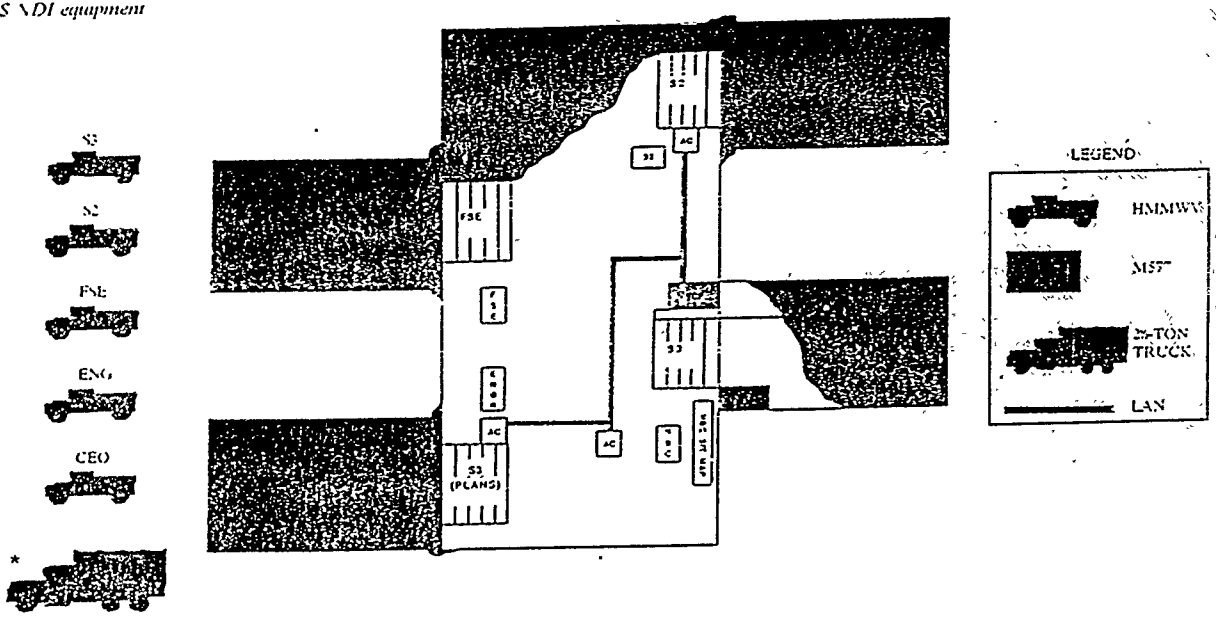


APPENDIX 2
MCS Console Distribution, from Ford Aerospace Corp., untitled information brochure.

SUPPORTS THE COMMANDER AND STAFF

BRIGADE MAIN CP

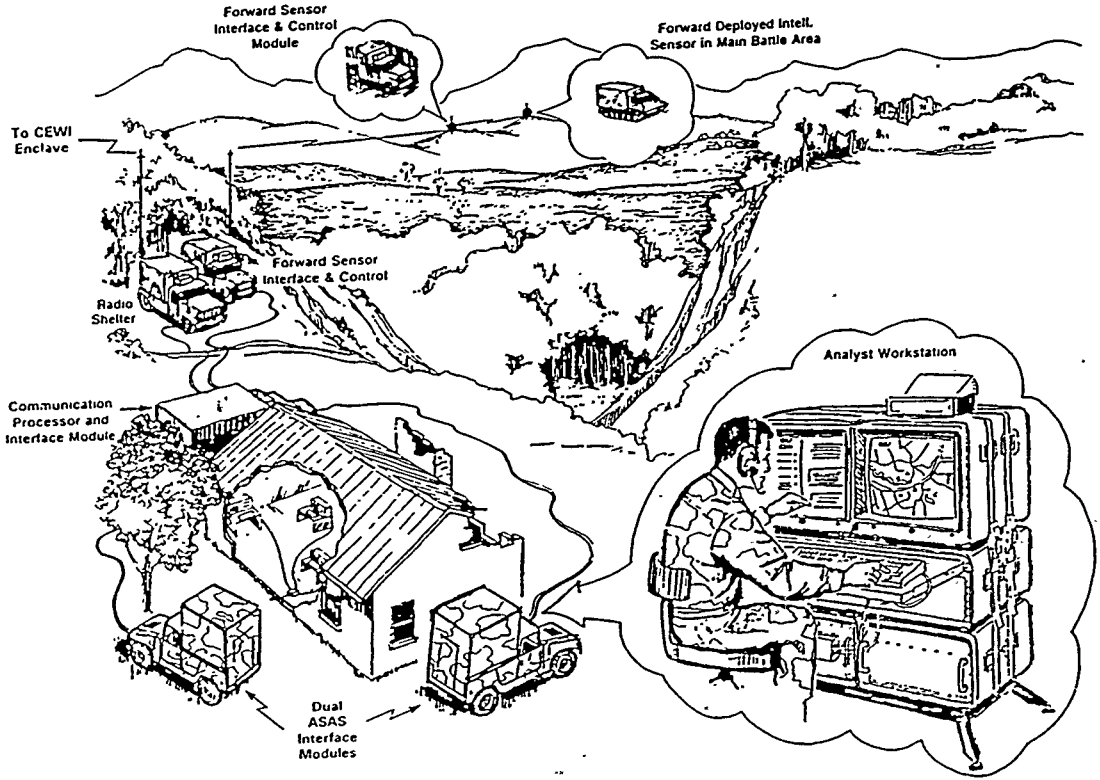
The four M577's of the brigade Main have a TCT, a TCP, and three AC's to tie the unit into the MCS network. The wheeled vehicles that are tactically dispersed with the brigade can be used to carry the MCS VDI equipment



* *The 2 1/2-ton truck depicted is not part of the S2 or S3 section TOE*

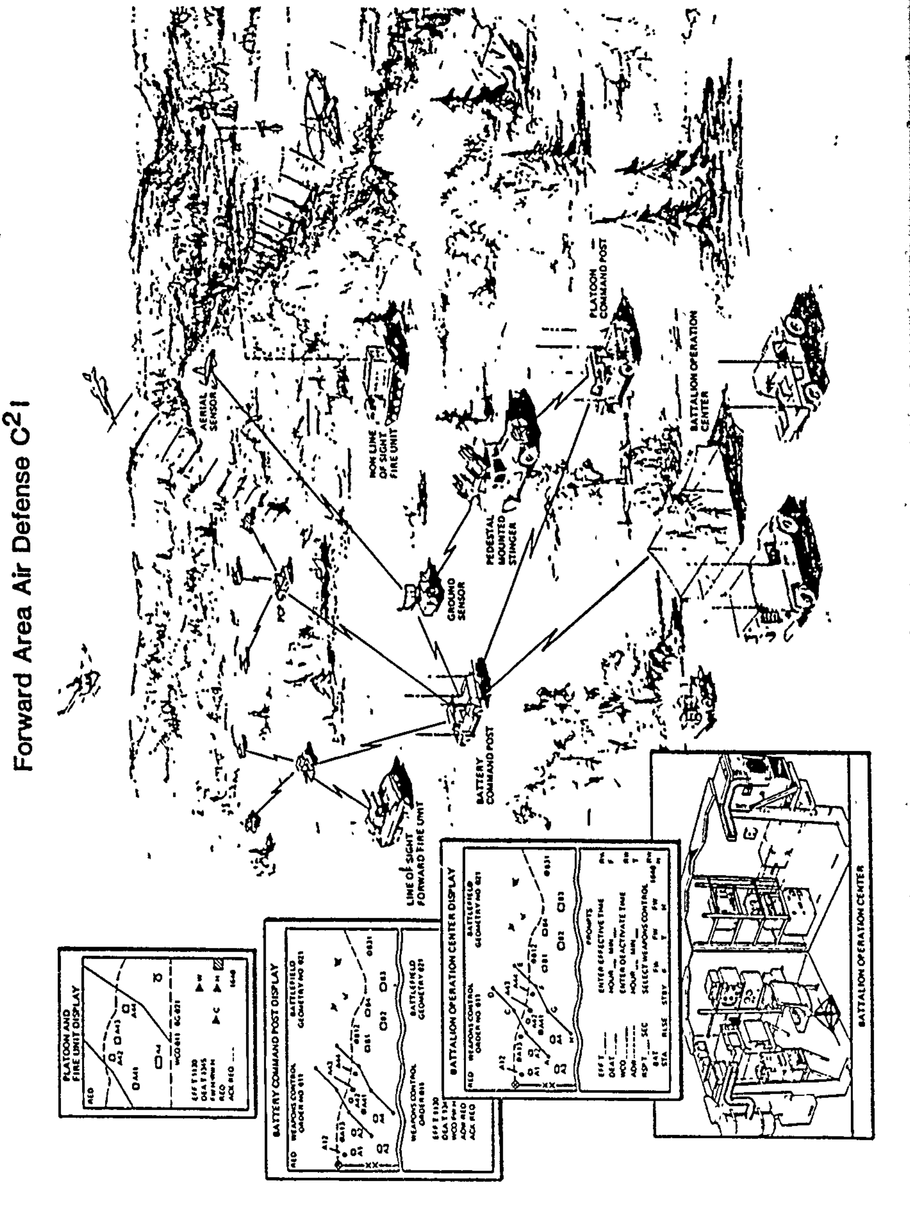
MCS EQUIPMENT LOCATION

ALL SOURCE ANALYSIS SYSTEM



APPENDIX 3
All Source Analysis System
Weapons Systems 1990,
HQs, Dept. of the Army.

APPENDIX 4
Forward Area Air Defense C2I
Weapons Systems 1990,
HQs, Dept. of the Army.



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37. James W. Rawles, "ASAS: From Confusion to Fusion," Defense Electronics, 21, No. 10 (Oct 89), pp. 108-112.

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41. ibid, p. 24.

42. Clarence A.Robinson, Jr., "Army's Digital Devices Move Presses Tactical Automation," Signal, 44, No. 3 (Nov 90), p. 25.

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47. Rick Makowski, "EPLRS-More Than Just Data," Army Communicator, 15, No. 1 (Winter/Spring 90), p. 14.

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